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APPRAISING FOREST FIRE DAMAGE IN NEW JERSEY

ALLEGHENY FOREST EXPERIMENT STATION
FOREST MANAGEMENT

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UNITED STATES DEPARTMENT OF AGRICULTURE

Forest Service

Allegheny Forest Experiment Station
In cooperation with the University of Pennsylvania
3437 Woodland Avenue, Philadelphia, Pa.
Hardy L. Shirley, Director

This paper was prepared by the

NEW JERSEY DEPARTMENT OF CONSERVATION AND DEVELOPMENT

E. B. Moore and A. F. Waldron, Assistant Foresters
of the Division of Forests and Parks
W. J. Seidel, Deputy State Firewarden of the Forest
Fire Service

and the

ALLEGHENY FOREST EXPERIMENT STATION

S. Little, Assistant Silviculturist
of the Forest Management Staff

APPRAISING FOREST FIRE DAMAGE IN NEW JERSEY

Introduction

As in all States cooperating in forest fire protection with the Federal Government, New Jersey annually submits data showing the amount of damage caused by forest fires. This information has been primarily concerned with damage to standing timber and physical improvements. The amount of loss caused by destruction of the latter is relatively easy to ascertain; but damage to standing timber is another matter.

The New Jersey Forest Fire Service desired a more accurate method of appraising fire damage to standing timber than had heretofore been used. As a result, the method described in this paper was evolved by the joint effort of the New Jersey Department of Conservation and Development and the Allegheny Forest Experiment Station.

Possible Methods of Appraising Damage to Timber

There are three possible methods of appraising the damage inflicted by forest fires on standing timber. These are:

(1) Classifying burned areas into various types, and computing the total amount of damage from standard per acre values for the timber in each type.

(2) Allowing each warden to guess or estimate the value of the stand in each burned area.

(3) Making a more or less extensive cruise of stands on burned areas.

The first alternative has been the method used in the Fire Service's estimates of damage. These are obtained by classifying burned areas into certain major types which, in turn, are subdivided into 10-year age classes, and then by using standard per acre values computing the total amount of damage. The greatest fault of this system lies in the use of average values based on well-stocked stands. Additional faults are as follows:

(1) It is almost impossible for wardens to segregate accurately the types into subclasses based on 10-year age intervals.

(2) Even if age classes and types are determined accurately, no allowance is made for the different sizes that stands attain at the same age because of different growth capacities of the sites involved.

(3) Differences in stand densities are not considered.

The second alternative, which incidentally is the one most commonly used throughout the country, permits each individual to estimate the amount of damage. This method was rejected because it often reflects personal variation, rather than actual differences in value.

The third alternative is not commonly used in estimating fire damage - except on public lands or on private areas where the owners attempt to collect damages. Yet it is the only method which will permit reasonably accurate appraisals, revealing actual values and reflecting differences in stand densities and size of trees. Naturally, for the purpose of providing State estimates of fire damage to standing timber, it is not permissible to spend a large amount of the protection funds; so a modified version of this method was developed. It is believed that this system, described in the following paragraphs, will give reasonably accurate data at a moderate cost.

Classification of Burned Areas

Burned areas will be classified according to the descriptions given in "Forest Fuel Types of New Jersey." 1/ In that report twenty-seven types have been described, and a photograph of each is given. These types are based on: (1) species composition; (2) site, upland or lowland; (3) type of stand, evenaged or unevenaged; and (4) size class of stand if evenaged. Three broad size classes were used; reproduction (0 to 3 inches d.b.h.), sapling-pole (3 to 6 or 8 inches d.b.h.) 2/, and mature (over 6 or 8 inches d.b.h.) 2/. These types are all clearly distinguishable, and local wardens have no difficulty in classifying burned areas by this method.

The reasons for using these classes are as follows:

(1) It provides for a segregation of the burned area into tracts varying little as to composition, density, and size of the stands.

(2) As a result, fewer plots have to be tallied to provide reasonably accurate estimates of the timber on burned areas.

The actual classification of burned areas by types can be easily made by using aerial photographs and checking the areas in the field.

1/ New Jersey Department of Conservation and Development in cooperation with the Allegheny Forest Experiment Station. 1941. Forest fuel types of New Jersey. Multilithed Report, illus.

2/ Dependent on the type.

Determining the Area in Each Type

Once the boundaries of each type have been determined, its area can be obtained either in the field by actual measurements (such as pacing) or in the office by use of a planimeter. Naturally the latter method will only be used on large fires.

Number of Plots in Each Type

After the burned area has been subdivided into the various types and the acreage in each determined, the appropriate number of plots can be tallied. Since difficulty would be experienced in determining what constituted an appropriate number of plots for each type, standards, based on acreage, were arbitrarily set up. These are given in Table 1.

Table 1.

Number of Plots to be Tallied in Each Type

by Acreage Classes

Acreage in Each Type	Number of Plots
10 acres or less	1
11 to 100 acres	2
200 to 300 acres	3
400 to 500 acres	4
600 to 1000 acres	5
2000 acres	6
3000 acres	7
4000 acres	8
etc.	etc.

Size of Plots

Plots will usually be 1/4-acre in size. 1/10-acre plots will be used in stands of dense reproduction, where 1/4-acre plots would be difficult to tally. 1/2-acre plots will be used in open, mature stands where conditions are such that larger plots can be readily tallied.

Location of Plots

In locating plots, areas typical of the whole burn should be

selected. On large tracts, plots should be at least 300 to 500 feet from a road. Open spots or dense stands not typical of the whole should be avoided; but a great deal of time should not be spent in determining this point. If no striking differences can be noted by visual examination, the sample plot can be regarded as typical.

One alleviating factor in this selection is that although the plots form only a very small portion of the whole acreage, the resulting errors will be largely compensating.

Plot Tallies

On each plot the number of trees and estimated average d.b.h. (to the nearest inch) will be tallied. These will be recorded separately for the overstory and understory of unevenaged stands, and for oaks and pines exceeding four inches d.b.h. in oak-pine stands. Tally sheets will show the fire number, area burned (total and by types), date burned, date tallied, forest type, plot number, size of plot, number of trees and estimated average d.b.h.

Reproduction averaging less than 1.5" in diameter at b.h. will not be tallied; but only the acreage in this class will be given.

After a little experience, plots can be tallied at the rate of one every ten to fifteen minutes.

Computation of Values

A. Where plot tallies are made. To obtain the value for a burned area in any type, the following steps will be used.

(1) Multiply the appropriate value per tree from Table 2 3/ by the number of trees on a plot to obtain the stand value for that plot.

(2) Total the values for all plots in each type, and divide by the acreage included in plots to obtain the average value per acre for each type.

(3) Multiply the per acre value by the acreage in the type involved to obtain the total timber value.

3/ Table 2 gives the value per tree for the various types found in New Jersey, and was prepared by the Division of Forests and Parks of the State Department. It groups many of the types which doubtless should be segregated, but not enough information is available to warrant that separation at the present time.

Table 2.

Value Per Tree by D.B.H. Classes

D.B.H. Inches	South Jersey				North Jersey	
	Delaware Valley Hardwoods 1/	White Cedar 2/	Pine Barrens			
			Pine 3/	Hardwoods 4/	Upland 5/	Lowland 6/
2	$ .001	$ .0005	$ .001	$ .001	$ .00094	$ .00094
3	.003	.0023	.005	.005	.0029	.0021
4	.01	.008	.011	.010	.010	.0072
5	.03	.024	.021	.017	.027	.020
6	.06	.056	.04	.025	.059	.043
7	.12	.11	.07	.035	.113	.076
8	.20	.18	.12	.047	.18	.12
9	.30	.29	.19	.061	.26	.16
10	.43	.40	.28	.077	.36	.22
11	.55	.54	.36	.096	.49	.28
12	.70	.68	.47	.12	.63	.34
13	.88	.86	.58	.14	.79	.42
14	1.05	1.05	.70	.16	.94	.50
15	1.25		.83	.19	1.13	.59
16	1.50		.95	.21	1.33	.70
17	1.80		1.10	.24	1.60	.80
18	2.15		1.20	.26	1.88	.95
19	2.50				2.20	1.10
20	2.90				2.50	1.25
21	3.30				2.90	1.45
22	3.70				3.30	1.70
23					3.90	1.95
24					4.50	2.25
25					5.20	2.60
26					5.90	2.95
27					6.60	3.30

1/ Includes the Hardwood Upland stands of the Delaware Valley.
2/ " all White-cedar stands.
3/ " all Pine types of South Jersey and the pine trees in the Oak-Pine type.
4/ " all hardwoods found in the hardwood and Oak-Pine types of the Pine Barrens.
5/ " all upland types of North Jersey.
6/ Limited to the Hardwood Lowland types of North Jersey

B. Where no plot tallies are necessary. No plots will be tallied on areas falling in the reproduction classes where the average diameter is less than 1.5", or on old fields, fresh marsh, or salt marsh. For these, the standard values per acre shown in Table 3 will be used. To obtain the total value for any burned area falling in one of these categories, multiply the acreage in the type by the standard value per acre.

Table 3.

Standard Values Per Acre for Grass Types and for Reproduction Stands Less than 1.5" D.B.H.

Principal Location	Type	Value per Acre
South Jersey	Salt Marsh	$1.00
North and South Jersey	Grass - Fresh Marsh	1.00
North and South Jersey	Grass - Old Field	1.00
South Jersey	White-cedar Evenaged Reproduction	2.00
South Jersey	Pine Lowland Evenaged Reproduction	1.00
South Jersey	Pine Upland Evenaged Reproduction	1.00
South Jersey	Pine-Scrub Oak Evenaged (Plains)	1.00
South Jersey	Oak-Pine Evenaged Reproduction	1.00
North and South Jersey	Hardwood Lowland Evenaged Reproduction	1.00
South Jersey (Pine Barrens)	Hardwood Upland Evenaged Reproduction	1.00
South Jersey (Delaware Valley)	Hardwood Upland Evenaged Reproduction	1.50
North Jersey	Hardwood Upland Evenaged Reproduction	1.50

In Table 3 it will be noted that one dollar per acre is the minimum value allowed. Certain stands of reproduction are undoubtedly worth more on the basis of timber value and are so appraised. For grass areas, and some other reproduction stands, the one-dollar value includes intangibles, such as injury to wild life or the setting back of natural succession.

C. Where a combination of methods is necessary. A combination of the above methods will be used for unevenaged stands having reproduction less than 1.5" d.b.h. In such cases the overwood will be valued as under A, and the reproduction as under B.

Table 4 illustrates the methods described above by presenting the computations for one South Jersey fire.

Table 4.

An Example of Damage
Computations for One South Jersey Fire

Forest Type	PLOT DATA				Average Value Per Acre	Total Area Acres	Total Value
	Size of Plot	No. of Trees	Size of Trees	Plot Value			
Oak-Pine Evenaged Reproduction			1"		$1.00	800	$800
Oak-Pine Uneven-aged	1/4 acre	18 (pines)	8"	$2.16			
		200	2"	0.20			
	"	15 (pines)	5"	0.32			
		Understory	1"	0.25			
	"	3 (pines)	14"	2.10			
		500	2"	0.50			
	"	3 (pines)	8"	0.36			
		Understory	1"	0.25			
	"	40 (pines)	6"	1.60			
		Understory	1"	0.25			
Total for 1.25 Acres				$7.99	$6.39	600	$3,834.00
Grand Total						1,400	4,634.00

Reductions in Timber Losses

Because of salvage operations. In many sections of the country, fire-damaged or fire-killed timber may be salvaged, so that the timber

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value of the stand prior to burning does not represent a total loss. In New Jersey it is estimated that not more than 50% of the fire-damaged stands are ordinarily salvaged, and that when such operations are undertaken the values derived are relatively small. For these reasons, no reduction in timber losses on this account is deemed necessary.

Because of incomplete damage. Fires vary greatly in their intensity and size, and consequently in the resulting damage to forest stands. Small surface fires do not kill or damage as large a proportion of the stand as do large crown fires. Acre for acre, the fires in the class, 1/4-acre or less, cause far less damage to a forest stand than those over 50 or 300 acres in size. Information on the amount of damage caused by different types of fires on trees of varying sizes in the various forest types is lacking; and therefore, reductions for this factor have not been included.

Conclusions

In determining the damage caused by forest fires to standing timber on private land, a detailed cruise to obtain accurate estimates is not justified. Consequently, two general methods have been commonly used throughout the country:

I. Allowing each warden to guess or estimate the damage.

II. Segregating burned areas into more or less artificial classes based on type and age.

This paper describes a system of determining damage based on a rough timber cruise of the burn and segregation of areas according to type and size. Plots are tallied by counting trees and ocularly estimating the average diameter. By use of standard tree values, damage estimates are computed. In a few cases standard values per acre will be used. Reductions for timber salvage or incomplete damage have not been included.

It is recognized that this method of damage appraisal is only approximate, but it is believed to be adequate for the objectives in view.

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